PATENT
Attorney Docket No. 401279/YPLEE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

JAE-SUNG LEE

Art Unit: Unassigned

Application No.: Unassigned

Examiner: Unassigned

Filed: June 29, 2001

For: LIQUID PHASE OXIDATION REACTOR

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

Prior to the examination of the above-identified patent application, please enter the following amendments and consider the following remarks.

IN THE SPECIFICATION:

Replace the paragraph beginning at page 1, line 12 with:

Typically, liquid phase oxidation reactions are widely used for a process of manufacturing compounds. A process for manufacturing an aromatic organic acid is a representative example of liquid phase oxidation reactions. Aromatic organic acids are important fundamental chemical materials, and in particular starting materials of fibers, resins, and plasticizers and the like. For example, terephthalic acids for polyester fibers have been produced in large quantities throughout the world. A conventional liquid phase oxidation reactor for manufacturing an aromatic organic acid is constructed such that a rotary stirring blade is installed in a cylindrical reaction vessel. In order to perform liquid phase oxidation, reactants including alkyl substituted aromatics such as para-xylene and a mixture of reaction solvents such as acetic acid, and an oxidation catalyst are supplied to

a reaction vessel while an oxygen containing gas such as air is supplied to the stirring blade.

Replace the paragraph beginning at page 2, line 4 with:

Accordingly, to achieve the above object, the present invention provides a liquid phase oxidation reactor including: a substantially cylindrical reaction vessel having an interior space of a predetermined volume; a lid combined with the reaction vessel on top of the reaction vessel; one or more stirring blades disposed within the reaction vessel and rotating by a driving source disposed on the outside of the reaction vessel; a liquid phase supplying line disposed at a sidewall of the reaction vessel 11 for supplying a liquid phase reactant to the reaction vessel; a liquid phase discharging line disposed at a sidewall of the reaction vessel for draining a product obtained through a chemical reaction out of the reaction vessel; a gas feed nozzle formed in a bent shape for supplying an oxygen containing gas to the reaction vessel; and an angle adjusting means for supporting the gas feed nozzle so that the gas feed nozzle is turned so that the outlet thereof faces one of the stirring blades or the interior sidewall of the reaction vessel. The angle of the gas feed nozzle is adjusted in order to control effective contact time during which liquid is in contact with gas reactants and to minimize the burning of a solvent. The angle adjusting means comprises a first bearing fixed into a through hole in the reaction vessel for supporting the gas feed nozzle so that the gas feed nozzle can be turned and a control lever fixed to the gas feed nozzle disposed on the outside of the reaction vessel and manipulated by a user's hands. The angle adjusting means further includes a second bearing disposed between the gas feed nozzle and a gas supplying line for supplying the oxygen containing gas to the gas feed nozzle for supporting the gas feed nozzle so that the gas feed nozzle can turn with respect to the gas supplying line.

Replace the paragraph beginning at page 6, line 23 with:

For example, in order to operate the liquid phase oxidation reactor and manufacture aromatic organic acid, first, aromatic compounds having alkyl substitute(s) and/or partially oxidized alkyl substitute(s), a reaction solvent, and an oxidation catalyst are supplied to the reaction vessel 11. More specifically, the aromatic compounds may be monocyclic or polycyclic, and the alkyl substitutes may be alkyl radicals containing 1-4

carbon atoms such as methyl, ethyl, n-propyl, or isopropyl. The partially oxidized alkyl radicals may be phenylene, acylene, carbonylene, or hydroxyalkylene radicals.

Replace the paragraph beginning at page 7, line 1 with:

Examples of an aromatic compound having alkyl substitute(s) may include: a dialkylbenzene or polyalkylbenzene series containing 1–4 carbon atoms and 2-4 alkyl radicals such as m-disopropylbenzene, p-disopropylbenzene, m-xylene, p-xylene, trimethylbenzene, or tetramethylbenzene; a dialkylnaphthalene or polyalkylnaphthalene series containing 1-4 carbon atoms and 2-4 alkyl radicals such as dimethylnaphthalene, diethylnaphthalene, or disopropylnaphthalene; and a polyalkylbiphenyl series containing 1-4 carbon atoms and 2-4 alkyl radicals such as dimethylbiphenyl. Furthermore, an aromatic compound having one or more partially oxidized alkyl radicals refers to an aromatic compound having one or more alkyl substitutes of the alkyl substituted aromatic compound as described above which are partially oxidized to phenyl, acyl, carbonyl, or hydroxyalkyl. The aromatic compound having one or more partially oxidized alkyl radicals may 3-methylbenzaldehyde, 4-methylbenzaldehyde, m-toluic acid, p-toluic acid, 3-phenylbenzoic (benzophosphoric) acid, 4-phenyl-benzoic acid, or phenylnaphthalene.

Replace the paragraph beginning at page 7, line 16 with:

In the method of manufacturing an aromatic organic acid according to the present invention, a heavy metal compound and a bromide compound are used as catalyst materials. A heavy metal of the heavy metal compound may be cobalt, manganese, nickel, chromium, zirconium, copper, lead, hafnium or cerium, or a combination of the above heavy metals, and most preferred is a combination of a manganese and a cobalt species. The heavy metal compound may be an acetate, nitrate, acetylacetonate, naphthalate, stearinate, and bromide, and most preferred is an acetate. Examples of the bromide compound may include an inorganic bromide such as molecular bromine, hydrogen bromide, sodium bromide, potassium bromide, cobalt bromide, or manganese bromide, and organic bromide such as methylbromide, methylenebromide, bromoform, benzyl bromide, bromomethyltoluene, dibromoethane, tribromoethane, or tetrabromoethane.

IN THE CLAIMS:

Replace the indicated claims with:

1. (Amended) A liquid phase oxidation reactor comprising:

a substantially cylindrical reaction vessel having an interior space of a predetermined volume;

a lid combined with the reaction vessel on top of the reaction vessel;

one or more stirring blades disposed within the reaction vessel and rotated by a driving source disposed on the outside of the reaction vessel;

a liquid phase supplying line disposed at a sidewall of the reaction vessel for supplying a liquid phase reactant to the reaction vessel;

a liquid phase discharging line disposed at another sidewall of the reaction vessel for draining a product obtained through a chemical reaction out of the reaction vessel;

a gas feed nozzle formed in a bent shape for supplying an oxygen containing gas to the reaction vessel; and

an angle adjusting means for supporting the gas feed nozzle so that the gas feed nozzle is turned so that an outlet thereof faces one of the stirring blades or an interior sidewall of the reaction vessel.

3. (Amended) The liquid phase oxidation reactor of claim 1, wherein the angle adjusting means further comprises a control lever fixed to the gas feed nozzle disposed on the outside of the reaction vessel for manual manipulation.

5. (Amended) A liquid phase oxidation reactor comprising:

a substantially cylindrical reaction vessel having an interior space of a predetermined volume;

a lid combined with the reaction vessel on top of the reaction vessel;

one or more stirring blades disposed within the reaction vessel and rotating by a driving source disposed on the outside of the reaction vessel;

a liquid phase supplying line disposed at a sidewall of the reaction vessel for supplying a liquid phase reactant to the reaction vessel;

a liquid phase discharging line disposed at another sidewall of the reaction vessel for draining a product obtained through a chemical reaction out of the reaction vessel; and

a gas feed nozzle formed in a bent shape for supplying an oxygen containing gas to the reaction vessel and fixedly installed so that an outlet thereof faces an interior sidewall of the reaction vessel.

REMARKS

The Examiner is respectfully requested to enter these preliminary amendments in the application prior to examination. The specification is amended to correct typographical errors due to translation. Claims 1, 3, and 5 are amended to fix minor informalities.

Conclusion

The application is considered in good and proper form for allowance.

If, in the opinion of the Examiner, a telephone conference would expedite the prosecution of the subject application, the Examiner is invited to call the undersigned attorney.

Respectfully submitted,

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SPECIFICATION, AND CLAIMS AS PRELIMINARILY AMENDED

Amendments to the paragraph beginning at page 1, line 12:

Typically, liquid phase oxidation reactions are widely used for a process of manufacturing compounds. A process for manufacturing an aromatic organic acid is a representative example of liquid phase oxidation reactions. Aromatic organic acids are important fundamental chemical materials, and in particular starting materials of fibers, resins, and ~~plasticjzers~~ plasticizers and the like. For example, terephthalic acids for polyester fibers have been produced in large quantities throughout the world. A conventional liquid phase oxidation reactor for manufacturing an aromatic organic acid is constructed such that a rotary stirring blade is installed in a cylindrical reaction vessel. In order to perform liquid phase oxidation, reactants including alkyl substituted aromatics such as para-xylene and a mixture of reaction solvents such as acetic acid, and an oxidation catalyst are supplied to a reaction vessel while an oxygen containing gas such as air is supplied to the stirring blade.

Amendments to the paragraph beginning at page 2, line 4:

Accordingly, to achieve the above object, the present invention provides a liquid phase oxidation reactor including: a substantially cylindrical reaction vessel having an interior space of a predetermined volume; a lid combined with the reaction vessel on top

of the reaction vessel; one or more stirring blades disposed within the reaction vessel and rotating by a driving source disposed on the outside of the reaction vessel; a liquid phase supplying line disposed at a sidewall of the reaction vessel 11 for supplying a liquid phase reactant to the reaction vessel; a liquid phase discharging line disposed at a sidewall of the reaction vessel for draining a product obtained through a chemical reaction out of the reaction vessel; a gas feed nozzle formed in a bent shape for supplying an oxygen containing gas to the reaction vessel; and an angle adjusting means for supporting the gas feed nozzle so that the gas feed nozzle is turned so that the outlet thereof faces one of the stirring blades or the interior sidewall of the reaction vessel. The angle of the gas feed nozzle is adjusted in order to control effective contact time during which liquid is in contact with gas reactants and to minimize the burning of a solvent. The angle adjusting means comprises a first bearing fixed into a through hole in the reaction vessel for supporting the gas feed nozzle so that the gas feed ~~nzo~~ nozzle can be turned and a control lever fixed to the gas feed nozzle disposed on the outside of the reaction vessel and manipulated by a user's hands. The angle adjusting means further includes a second bearing disposed between the gas feed nozzle and a gas supplying line for supplying the oxygen containing gas to the gas feed nozzle for supporting the gas feed nozzle so that the gas feed nozzle can turn with respect to the gas supplying line.

Amendments to the paragraph beginning at page 6, line 23:

For example, in order to operate the liquid phase oxidation reactor and manufacture aromatic organic acid, first, aromatic compounds having alkyl substitute(s) and/or partially oxidized alkyl substitute(s), a reaction solvent, and an oxidation catalyst are supplied to the reaction vessel 11. More specifically, the aromatic compounds may be monocyclic or polycyclic, and the alkyl substitutes may be alkyl radicals containing 1-4 carbon atoms such as methyl, ethyl, n-propyl, or isopropyl. The partially oxidized alkyl radicals may be ~~phemylene~~ phenylene, acylene, carbonylene, or hydroxyalkylene radicals.

Amendments to the paragraph beginning at page 7, line 1:

Examples of an aromatic compound having alkyl substitute(s) may include: a dialkylbenzene or polyalkylbenzene series containing 1–4 carbon atoms and 2-4 alkyl

radicals such as m-disopropylbenzene, p-disopropylbenzene, m-xylene, p-xylene, trimethylbenzene, or tetramethylbenzene; a dialkylnaphthalene or polyalkylnaphthalene series containing 1-4 carbon atoms and 2-4 alkyl radicals such as dimethylnaphthalene, diethylnaphthalene, or disopropylnaphthalene; and a polyalkylbiphenyl series containing 1-4 carbon atoms and 2-4 alkyl radicals such as dimethylbiphenyl. Furthermore, an aromatic compound having one or more partially oxidized alkyl radicals refers to an aromatic compound having one or more alkyl substitutes of the alkyl substituted aromatic compound as described above which are partially oxidized to ~~phemyl~~ phenyl, acyl, carbonyl, or hydroxyalkyl. The aromatic compound having one or more partially oxidized alkyl radicals may 3-methylbenzaldehyde, 4-methylbenzaldehyde, m-toluic acid, p-toluic acid, 3-~~phemylbenzoic~~ phenylbenzoic (benzophosphoric~~?~~) acid, 4-~~-phemyl~~ phenyl-benzoic acid, or ~~phemylnaphthalene~~ phenylnaphthalene.

Amendments to the paragraph beginning at page 7, line 16:

In the method of manufacturing an aromatic organic acid according to the present invention, a heavy metal compound and a bromide compound are used as catalyst materials. A heavy metal of the heavy metal compound may be cobalt, manganese, nickel, chromium, zirconium, copper, lead, hafnium or cerium, or a combination of the above heavy metals, and most preferred is a combination of a manganese and a cobalt species. The heavy metal compound may be an acetate, nitrate, acetylacetonate, naphthalate, stearinate, and bromide, and most preferred is an acetate. Examples of the bromide compound may include an inorganic bromide such as ~~molecule~~ molecular bromine, hydrogen bromide, sodium bromide, potassium bromide, cobalt bromide, or manganese bromide, and organic bromide such as methylbromide, methylenebromide, bromoform, benzyl bromide, bromomethyltoluene, dibromoethane, tribromoethane, or tetrabromoethane.

Amendments to existing claims:

1. A liquid phase oxidation reactor comprising:

a substantially cylindrical reaction vessel having an interior space of a predetermined volume;

a lid combined with the reaction vessel on top of the reaction vessel;

one or more stirring blades disposed within the reaction vessel and ~~rotating~~ rotated by a driving source disposed on the outside of the reaction vessel;

a liquid phase supplying line disposed at a sidewall of the reaction vessel for supplying a liquid phase reactant to the reaction vessel;

a liquid phase discharging line disposed at ~~a~~ another sidewall of the reaction vessel for draining a product obtained through a chemical reaction out of the reaction vessel;

a gas feed nozzle formed in a bent shape for supplying an oxygen containing gas to the reaction vessel; and

an angle adjusting means for supporting the gas feed nozzle so that the gas feed nozzle is turned so that ~~the~~ an outlet thereof faces one of the stirring blades or ~~the~~ an interior sidewall of the reaction vessel.

3. The liquid phase oxidation reactor of claim 1, wherein the angle adjusting means further comprises a control lever fixed to the gas feed nozzle disposed on the outside of the reaction vessel ~~and manipulated by a user's hands~~ for manual manipulation.

5. A liquid phase oxidation reactor comprising:

a substantially cylindrical reaction vessel having an interior space of a predetermined volume;

a lid combined with the reaction vessel on top of the reaction vessel;

one or more stirring blades disposed within the reaction vessel and rotating by a driving source disposed on the outside of the reaction vessel;

a liquid phase supplying line disposed at a sidewall of the reaction vessel for supplying a liquid phase reactant to the reaction vessel;

a liquid phase discharging line disposed at ~~a~~ another sidewall of the reaction vessel for draining a product obtained through a chemical reaction out of the reaction vessel; and

a gas feed nozzle formed in a bent shape for supplying an oxygen containing gas to the reaction vessel and fixedly installed so that ~~the~~ an outlet thereof faces ~~the~~ an interior sidewall of the reaction vessel.

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CLAIMS PENDING AFTER PRELIMINARY AMENDMENT

1. A liquid phase oxidation reactor comprising:

a substantially cylindrical reaction vessel having an interior space of a predetermined volume;

a lid combined with the reaction vessel on top of the reaction vessel;

one or more stirring blades disposed within the reaction vessel and rotated by a driving source disposed on the outside of the reaction vessel;

a liquid phase supplying line disposed at a sidewall of the reaction vessel for supplying a liquid phase reactant to the reaction vessel;

a liquid phase discharging line disposed at another sidewall of the reaction vessel for draining a product obtained through a chemical reaction out of the reaction vessel;

a gas feed nozzle formed in a bent shape for supplying an oxygen containing gas to the reaction vessel; and

an angle adjusting means for supporting the gas feed nozzle so that the gas feed nozzle is turned so that an outlet thereof faces one of the stirring blades or an interior sidewall of the reaction vessel.

2. The liquid phase oxidation reactor of claim 1, wherein the angle adjusting means comprises a first bearing fixed into a through hole in the reaction vessel for supporting the gas feed nozzle so that the gas feed nozzle can be turned.

3. The liquid phase oxidation reactor of claim 1, wherein the angle adjusting means further comprises a control lever fixed to the gas feed nozzle disposed on the outside of the reaction vessel for manual manipulation.

4. The liquid phase oxidation reactor of claim 3, wherein the angle adjusting means further comprises a second bearing disposed between the gas feed nozzle and a gas supplying line for supplying the oxygen containing gas to the gas feed nozzle for supporting the gas feed nozzle so that the gas feed nozzle can turn with respect to the gas supplying line.

5. A liquid phase oxidation reactor comprising:

a substantially cylindrical reaction vessel having an interior space of a predetermined volume;

a lid combined with the reaction vessel on top of the reaction vessel;

one or more stirring blades disposed within the reaction vessel and rotating by a driving source disposed on the outside of the reaction vessel;

a liquid phase supplying line disposed at a sidewall of the reaction vessel for supplying a liquid phase reactant to the reaction vessel;

a liquid phase discharging line disposed at another sidewall of the reaction vessel for draining a product obtained through a chemical reaction out of the reaction vessel; and

a gas feed nozzle formed in a bent shape for supplying an oxygen containing gas to the reaction vessel and fixedly installed so that an outlet thereof faces an interior sidewall of the reaction vessel.